Bridging and Routing Features for the Cisco uBR924 Cable Access Router

Feature Overview

The Cisco uBR924 cable access router is a fully-functional Cisco IOS router and standards-based bidirectional cable modem that gives a residential or small office/home office (SOHO) subscriber high-speed Internet or Intranet access and packet telephone services via a shared two-way cable system and IP backbone network. The Cisco uBR924 is based on the current Data-Over-Cable Service Interface Specifications (DOCSIS) standards.

The Cisco uBR924 cable access router connects computers, telephone equipment, and other customer premises devices at a subscriber site to the service provider's Hybrid/Fiber Coax (HFC) and IP backbone network. Subscribers can access the Internet at speeds of up to 10 Mbps as well as make telephone calls—all using the same cable system that delivers broadcast TV signals.

The Cisco uBR924 is a compact device that supports the direct connection of up to four PCs and has the familiar features and programming interface of other routers in Cisco's extensive line of small- and medium-sized business product offerings. The Cisco uBR924 provides packet data transport and network address translation for TCP/IP applications between home or office computers and the cable headend.

Note This document describes the features available in Cisco IOS Release 12.0(5)T.

You can configure the cable access router to act as a bridge or as a router. See Figure 1 and Figure 2. For more detailed descriptions of these options, see the "Configuration Options" section on page 3.

Figure 1 Cisco uBR924 in a Bridging Configuration

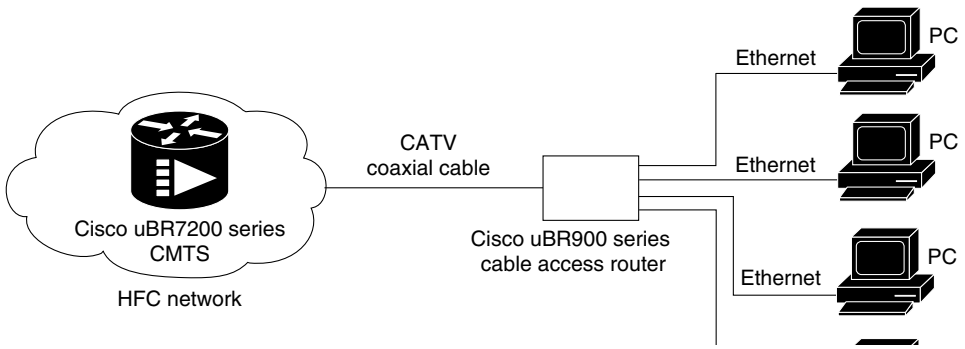
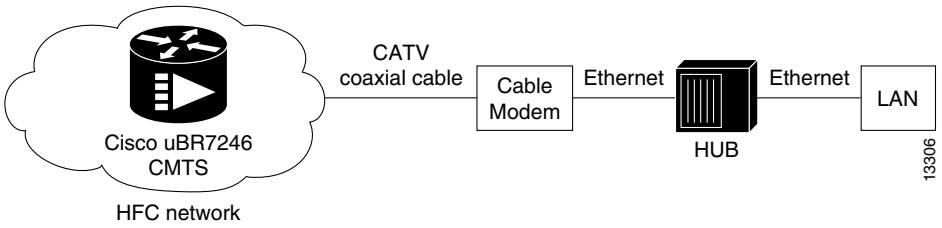


Figure 2 Cisco uBR924 in a Routing Configuration with a Hub



The Cisco uBR924 cable access router is referred to as a subscriber unit. The subscriber unit functions as an interface between the subscriber's customer premises equipment (CPE) devices at the small office/home office and the cable operator's network (the headend).

The Cisco uBR924 cable access router provides the following ports and connectors:

- A single F-connector interface to the cable network.
- Four RJ-45 (10BaseT Ethernet) hub ports to connect up to four computers directly to the cable access router when configured for either routing mode or DOCSIS-compliant bridging mode.

Note When in routing mode, one of the four Ethernet ports can be connected to an Ethernet hub, which then can connect additional computers or devices at the site.

- Two RJ-11 ports to connect two or more telephones to the cable system and IP backbone to support Voice over IP (VoIP) digitized voice transmission via H.323v2.
- One RJ-11 port to connect to a standard, analog telephone line (optional) to provide a backup Plain Old Telephone Service (POTS) connection to the Public Switched Telephone Network (PSTN) should the cable access router lose power.
- One RJ-45 console port to connect to an ASCII terminal or PC when locally troubleshooting or reconfiguring the cable access router.

When supporting basic Internet access, the cable interface requires no configuration or setup procedures other than to connect the Cisco uBR924 to the cable system. The unit is configured automatically using a configuration file generated by the cable service provider and delivered via the Cisco universal broadband router installed at the cable headend. The headend router provides a path from the cable access router to the Dynamic Host Configuration Protocol (DHCP) server for PC address assignment.

Note To support VoIP applications, a Cisco IOS image that supports voice must be downloaded to the Cisco uBR924 in addition to the configuration file that is automatically downloaded at power-up. For information on downloading IOS images to the Cisco uBR924, see the *Cisco uBR924 Cable Access Router Installation and Configuration Guide*.

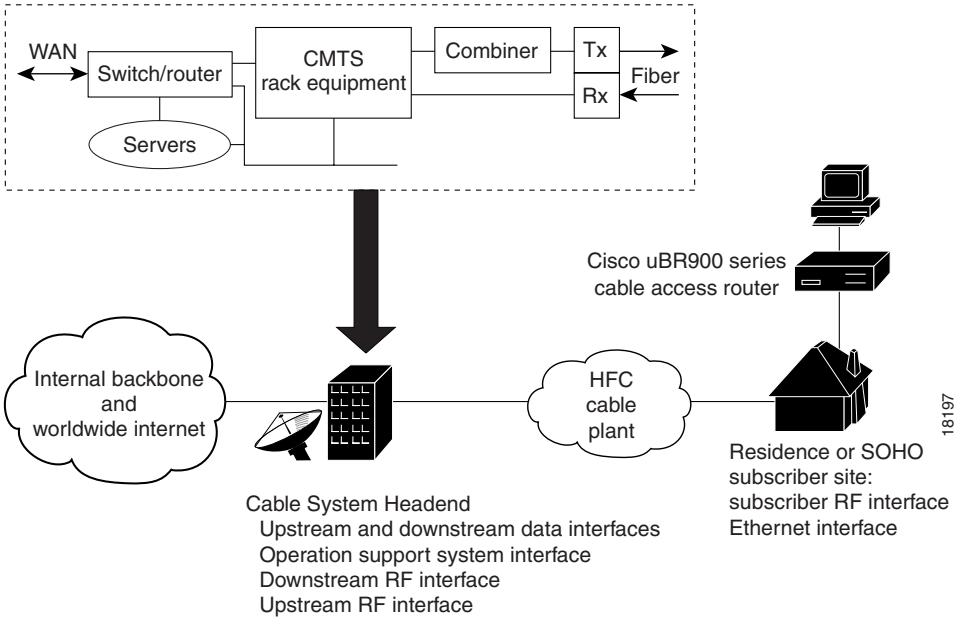
The PCs connected to the Cisco uBR924 cable access router must be configured for Internet Protocol (IP). Using DHCP, the universal broadband router assigns an IP subnet address to the cable access router each time it connects to the network. The IP addresses of the cable access router and the individual PCs attached to it enable the universal broadband router to route data to and from the PCs.

After the Cisco uBR924 is installed and the connected PCs are configured for IP, and after DHCP services are enabled and communication to the headend is established, the Cisco universal broadband router downloads configuration information to the cable access router. The initial configuration connection to the headend can take several minutes.

Figure 3 illustrates a broadband data cable system. Data transmitted to a Cisco uBR924 cable access router from the CMTS shares a 27 Mbps or 26 Mbps, 6 MHz data channel in the 88 to 860 MHz range. The Cisco uBR924 cable access router shares an upstream data rate of up to 10 Mbps on a 200 kHz-wide to 3.2 MHz-wide channel in the 5 to 42 MHz range.

Note End-to-end throughput varies based on the design and loading of network components, the mix of traffic, the processing speed and interface of the host server(s), the processing speed and local Ethernet performance of the subscriber's computer, as well as other parameters.

Figure 3 Typical Cisco Broadband Data Cable System



Configuration Options

The Cisco uBR924 cable access router is usually configured automatically at startup via a configuration file generated by the cable service provider and downloaded to the cable access router; however, you can also manually configure the cable access router to function either as a bridge or as a router. The following sections give brief descriptions of both applications.

Note When the Cisco uBR924 cable access router is shipped from the factory, it is configured by default for DOCSIS-compliant bridging.

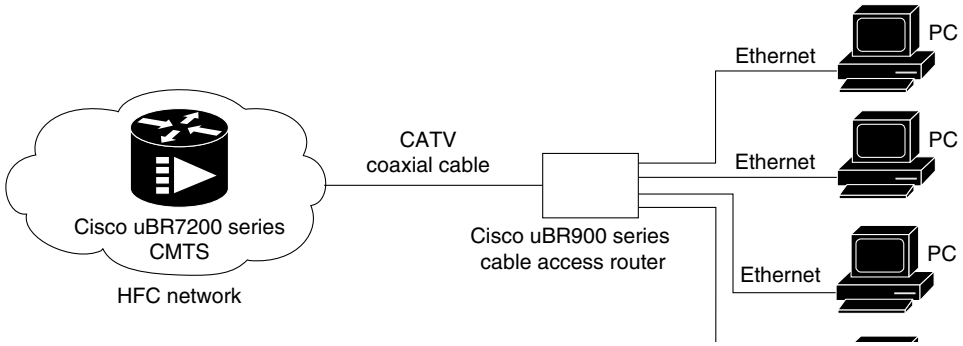
Bridging

The Cisco uBR924 cable access router complies with the DOCSIS standards for interoperable cable access routers; it supports full transparent bridging as well as DOCSIS-compliant transparent bridging.

In bridging applications, the Cisco uBR924 acts as a transparent bridge for up to four PCs plugged directly into the four Ethernet ports on the rear panel of the unit. The cable access router is connected to the Internet via the coaxial cable. All four Ethernet ports are treated as one Ethernet interface by the Cisco IOS software. The IP addresses for the PCs and the coaxial cable interface are typically in the same subnet, although this is not a requirement.

Note If the attached PCs and the coaxial cable interface are in different IP subnets, the cable interface must have a secondary address.

Figure 4 Cisco uBR924 in a Bridging Configuration



DOCSIS-compliant transparent bridging is the default configuration of the Cisco uBR924 cable access router. If your cable service provider is using a DHCP server, all you need to do is connect the cables and power on the cable access router; your service provider's configuration program will automatically configure both the coaxial cable interface and the bridging functionality. You do not need to set up IP addresses for the attached PCs or enter any Command Line Interface (CLI) configuration commands. This type of operation is called plug-and-play bridging.

In DOCSIS-compliant bridging mode, the cable access router is able to locate a downstream and upstream channel; find TOD, TFTP, and DHCP server(s); obtain an IP address; download a DOCSIS configuration file; and obtain DHCP parameters to work in a bridging mode. For a better understanding of the processes involved, refer to the online *Cisco uBR924 Cable Access Router Installation and Configuration Guide*.

In addition to the plug-and-play method of operation, you can configure a bridging application on the Cisco uBR924 using the CLI. See the sections "Configuring Bridging" on page 16 and "Customizing the Cable Access Router Interface" on page 19 for details.

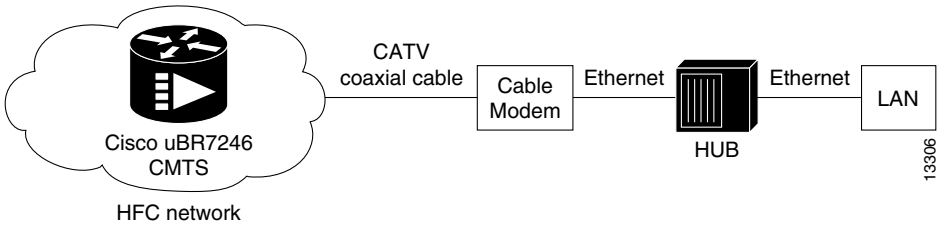
Note The ability of the cable access router to learn CPE MAC addresses in the DOCSIS-compliant bridging mode is controlled by the **MAC CPE** option in the DOCSIS configuration file. The Cisco uBR924 cable access router defaults to learning only one CPE MAC address unless this option is set to **4**. The maximum number of CPE MAC addresses that can be supported in bridging mode is **15**.

Routing

The Cisco uBR924 cable access router can also be configured to act as a router to preserve IP address space and limit broadcasts that can impact the performance of the network. A typical use would be if you are connecting the cable access router to an internal Ethernet hub that is connected to an existing PC network. You can also connect the cable access router directly to as many as four PCs via the Ethernet ports on the rear panel.

The cable access router is automatically configured to use the IP address of the Cisco headend cable router as the cable access router's default IP gateway.

Figure 5 Cisco uBR924 in a Routing Configuration with a Hub



You can configure the Cisco uBR924 cable access router to function as a router by using one of the following methods:

- By using TFTP to download a configuration file from the headend router to the cable access router that automatically configures it for routing.
- By connecting an ASCII terminal or PC to the console port on the back of the cable access router and using the CLI. See the sections "Configuring a Host Name and Password" on page 12 and "Customizing the Cable Access Router Interface" on page 19 for details

Benefits

The Cisco uBR924 cable access router provides the following benefits for data-over-cable applications:

- Allows telecommuters and small office/home office customers to leverage the high-bandwidth, low-cost, IP-based data and voice services offered by cable operators
- Enables the cost-effective deployment of advanced routing capabilities to the small office or home office site
- Prioritizes voice traffic ahead of data traffic, ensuring quality of service (QoS) over a shared cable infrastructure
- Leverages Cisco's industry-standard routing hardware and Cisco IOS software to deliver advanced networking services and applications such as virtual private networks (VPNs), support for multi-protocol networks, firewall security, and the ability to cost-effectively deploy local area networks (LANs)

Restrictions

When using the Cisco uBR924 cable access router, keep the following restrictions and limitations in mind:

- The Cisco uBR924 cable access router is able to implement multiples classes of service (CoS) on the cable interface; however, separate CoS streams are only available when the cable access router is connected to a headend that supports multiple classes of service per cable access router. In addition, the configuration file downloaded to the cable access router must specify the use of multiple classes of service.
- If the Cisco uBR924 cable access router is connected to a DOCSIS 1.0 headend that does not support multiple CoS per cable access router, voice and data will be mixed, and voice traffic will be transmitted on a best effort basis. This may cause poorer voice quality and lower data throughput when calls are being made from the cable access router's telephone ports. Voice quality is also affected when transmitting or downloading large files, as well as by other significant network traffic.

Note The Cisco uBR924 cable access router is typically configured at the headend. Most subscriber sites do not permit local configuration. Remote configuration is either disabled or routinely reset to settings in the provisioning or billing systems.

Caution Before attempting to reconfigure a Cisco uBR924 cable access router at a subscriber site, contact your network management, provisioning manager, or billing system administrator to ensure remote configuration is allowed. If remote configuration is disabled, settings you make and save at the local site will not remain in effect after the cable access router is powered off and back on. Instead, settings will return to the previous configuration.

Related Features and Technologies

The Cisco uBR924 cable access router is intended to be used in conjunction with a Cisco uBR7246 or a Cisco uBR7223 universal broadband router located at the cable operator's headend facility. Other compatible headend devices may also be used with the Cisco uBR924.

Related Documents

For related information on the Cisco uBR924 cable access router, refer to the following documents:

- *Cisco uBR924 Cable Access Router Quick Start Guide*
- *Cisco uBR924 Cable Access Router Installation and Configuration Guide*
- *Regulatory Compliance and Safety Info. for the Cisco uBR924 Cable Access Router*
- *Cisco uBR7246 Installation and Configuration Guide*
- *Cisco uBR7223 Installation and Configuration Guide*
- Cisco uBR7200 Series Configuration Notes
- *Cisco Network Registrar for the uBR7200 Series*
- *Regulatory and Safety Compliance for the Cisco uBR7246*
- *Regulatory and Safety Compliance for the Cisco uBR7223*
- *Cisco uBR7200 Series Universal Broadband Router Features*

Supported Platforms

The Cisco uBR924 cable access router is a standalone device; it works in conjunction with the Cisco uBR7246 and the Cisco uBR7223 universal broadband routers.

Prerequisites

In order to use the Cisco uBR924 cable access router for data-over-cable applications, the following tasks must be completed:

- All required CMTS routers, servers (DHCP, TFTP and TOD), network management systems, and/or other configuration or billing systems to be used in your network must be installed, configured, and operational. If you are using a Cisco uBR7246 or uBR7223 universal broadband router at the cable headend, refer to the *Cisco uBR7246 Installation and Configuration Guide* or the *Cisco uBR7223 Installation and Configuration Guide* for detailed information.
- Based on the quality and capacity of your cable plant, your system administrator or network planner must define your network's IP address allocation plan; spectrum management plan outlining the recommended operating parameters to optimize performance; channel plan identifying the channels available to assign to specific Cisco uBR924 cable access routers; and dial plan based on the supported VoIP protocol.
- The CMTS system administrator or appropriate personnel must specify the policy parameters for the Cisco uBR924 and all computers and other customer premises devices to be supported at subscriber sites. Refer to Cisco's Network Registrar (CNR) product documentation.
- The CMTS system administrator or appropriate personnel must define and push DHCP and Cisco uBR924 configuration files to the appropriate servers such that each router, when initialized, can transmit a DHCP request, receive its IP address, obtain its TFTP and TOD server addresses, and download its configuration file or updated Cisco IOS image.

Note The MAC address ensures that each router downloads only the file(s) intended for it.

- The Cisco uBR924 cable access router must be physically installed and cabled as follows:
  - To the headend via CATV coaxial cable. (High-quality, shielded RF coaxial cable with at least 80% braid is recommended.)
  - To at least one PC via the straight-through yellow Ethernet cable supplied with the cable access router. Refer to the *Cisco uBR924 Cable Access Router Quick Start Guide* for detailed information.

Note When the Cisco uBR924 is connected to an Ethernet hub, a crossover cable must be used. Category 5 UTP (10BaseT Ethernet) cable with RJ-45 connectors is recommended.

Note For subscriber sites that support multiple telephones or fax devices on a telephone line, all wiring associated with the telephone line extension must be in place. Inside wiring must be in compliance with the country of operation to prevent degradation of service.

- The CMTS system administrator must ensure appropriate databases are updated to activate and support the new subscriber account in the provisioning, billing and/or network management systems in place for your network once each router is registered with the CMTS.
- The PC(s) connected to the Cisco uBR924 cable access router must be configured for IP.
- Cisco IOS Release 11.3(4)NA or later must be running on the Cisco uBR924 cable access router. When the cable access router is up and running, you can display the IOS release number by entering the **show version** command from user EXEC mode.

Note If the Cisco uBR7246 universal broadband router at the cable headend is using MC16 modem cards, Cisco IOS Release 11.3(7)NA or later must be running on the Cisco uBR924 cable access router.

In order to use the Cisco uBR924 cable access router for VoIP-over-cable applications, the following additional conditions must be met:

- In order to run VoIP Fax, the uBR924 cable access router must be configured for voice and you must be using Cisco IOS Release 12.0(5)T or higher.

Supported MIBs and RFCs

The Cisco uBR924 cable access router supports the following:

- Cisco Standard MIBs:
  - Cisco Product MIB
  - Cisco Chassis MIB
  - Cisco Syslog MIB
  - Cisco Flash MIB
  - Bridge MIB
  - IF MIB
  - MIB-II
- Cisco VoIP MIBs:
  - Cisco Voice IF MIB
  - Cisco Voice Dial-Control MIB
  - Cisco Voice Analog IF MIB
  - Cisco Dial-Control MIB
- Radio Frequency Interface Specification—Developed by the Multimedia Cable Network System (MCNS) consortium. It defines the radio-frequency interface specification for high-speed data-over-cable systems.
- CiscoWorks—Network management program for planning, troubleshooting, and monitoring Cisco internetworks. CiscoWorks uses Simple Network Management Protocol (SNMP) to monitor all SNMP devices.
  - For more information about CiscoWorks on CCO, follow this path:
    Products & Ordering: Cisco Products: Network Management: CiscoWorks

  - For more information about CiscoWorks on the Documentation CD-ROM, follow this path: **Cisco Product Documentation: Network Management: CiscoWorks**

- Radio Frequency Interface (RFI) MIB—Specific to Data-Over-Cable Service Interface Specification (DOCSIS) cable implementations. The RIF MIB provides an interface that permits management of the Cisco uBR924 cable access router over the cable or Ethernet interface. Using SNMP management applications, this MIB allows access to statistics such as MAC, driver configuration, and counters.
- Cable Device MIB—Records statistics related to the configuration and status of the Cisco uBR924 cable access router. Statistics include an events log and device status. The Cable Device MIB is very similar to the RFI MIB in that both allow access to statistics; they are different in that the Cable Device MIB reports statistics on the cable access router, while the RFI MIB reports statistics on the radio frequency transmissions over the cable television line.

For descriptions of supported MIBs and how to use MIBs, see Cisco's MIB web site on CCO at http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml.

List of Terms and Acronyms

broadband—Transmission system that combines multiple independent signals onto one cable. In the cable industry, broadband refers to the frequency-division multiplexing of many signals in a wide bandwidth of RF frequencies using a hybrid fiber-coaxial (HFC) network.

CATV—Originally stood for Community Antenna Television. Now refers to any coaxial or fiber cable-based system that provides television services.

cable modem (CM)—A modulator-demodulator device that is placed at subscriber locations to convey data communications on a cable television system. The Cisco uBR924 cable access router is also a cable modem.

Cable Modem Termination System (CMTS)—A termination system located at the cable television system headend or distribution hub which provides complementary functionality to the cable modems, enabling data connectivity to a wide-are network.

cable router—A modular chassis-based router optimized for data-over-CATV hybrid fiber-coaxial (HFC) applications.

carrier—A signal on which another, lower-frequency signal is modulated in order to transport the lower-frequency signal to another location.

Carrier-to-Noise—C/N (also CNR). The difference in amplitude between the desired RF carrier and the noise in a portion of the spectrum.

channel—A specific frequency allocation and bandwidth. Downstream channels used for television are 6 MHz wide in the United States; 8 MHz wide in Europe.

CM—cable modem.

CMTS—Cable Modem Termination System.

coaxial cable—The principal physical media over which CATV systems are built.

CPE—Customer Premises Equipment

dB—Decibel. A measure of the relative strength of two signals.

dBm—Decibels with respect to one milliwatt. A unit of RF signal strength used in satellite work and other communications applications.

dBmV—Decibels with respect to one millivolt in a 75-ohm system. The unit of RF power used in CATV work in North America.

DHCP—Dynamic Host Configuration Protocol. This protocol provides a mechanism for allocating IP addresses dynamically so that addresses can be reused when hosts no longer need them.

DOCSIS—Data Over Cable Service Interface Specification. Defines technical specifications for equipment at both subscriber locations and cable operators' headends.

downstream—The set of frequencies used to send data from a headend to a subscriber.

FDM—Frequency Division Multiplexing. A data transmission method in which a number of transmitters share a transmission medium, each occupying a different frequency.

FEC—Forward Error Correction. In data transmission, a process by which additional data is added that is derived from the payload by an assigned algorithm. It allows the receiver to determine if certain classes of errors have occurred in transmission and, in some cases, allows other classes of errors to be corrected.

headend—Central distribution point for a CATV system. Video signals are received here from satellite (either co-located or remote), frequency converted to the appropriate channels, combined with locally originated signals, and rebroadcast onto the HFC plant. For a CATV data system, the headend is the typical place to create a link between the HFC system and any external data networks.

HFC—Hybrid fiber-coaxial (cable network). Older CATV systems were provisioned using only coaxial cable. Modern systems use fiber transport from the headend to an optical node located in the neighborhood to reduce system noise. Coaxial cable runs from the node to the subscriber. The fiber plant is generally a star configuration with all optical node fibers terminating at a headend. The coaxial cable part of the system is generally a trunk-and-branch configuration.

host—Any end-user computer system that connects to a network. In this document, the term host refers to the computer system connected to the LAN interface of the cable access router.

ingress noise—Over-the-air signals that are inadvertently coupled into the nominally closed coaxial cable distribution system. Ingress noise is difficult to track down and intermittent in nature.

MAC layer—Media Access Control sublayer. Controls access by the cable access router to the CMTS and to the upstream data slots.

MCNS—Multimedia Cable Network System Partners Ltd. A consortium of cable companies providing service to the majority of homes in the United States and Canada. This consortium has decided to drive a standard with the goal of having interoperable cable access routers.

MSO—Multiple System Operator. A cable service provider that operates in more than one geographic area, thus having multiple headend facilities.

narrowband—A single RF frequency.

NTSC—National Television Systems Committee. A United States TV technical standard, named after the organization that created the standard in 1941. Specifies a 6 MHz-wide modulated signal.

PAL—Phase Alternating Line. The TV system used in most of Europe, in which the color carrier phase definition changes in alternate scan lines. Utilizes an 8 MHz-wide modulated signal.

QAM—Quadrature Amplitude Modulation. A method of modulating digital signals onto a radio-frequency carrier signal in which the value of a symbol consisting of multiple bits is represented by amplitude and phase states of the carrier. QAM is a modulation scheme mostly used in the downstream direction (64-QAM, 256-QAM). 16-QAM is expected to be usable in the upstream direction. Numbers indicate number of code points per symbol. The QAM rate or the number of points in the QAM constellation can be computed by 2 raised to the power of <number of bits/symbol>. For example, 16-QAM has 4 bits per symbol, 64-QAM has 6 bits per symbol, and 256-QAM has 8 bits per symbol.

QPSK—Quadrature Phase-Shift Keying. A digital modulation method in which there are 2 data bits represented with each baud symbol.

ranging—The process of acquiring the correct timing offset such that the transmissions of a cable access router are aligned with the correct mini-slot boundary.

RF—Radio frequency. The portion of the electromagnetic frequency spectrum from 5 MHz to approximately 860 MHz.

SECAM—TV system used in France and elsewhere, utilizing an 8 MHz-wide modulated signal.

SID (Service ID)—A number that defines (at the MAC sublayer) a particular mapping between a cable access router (CM) and the CMTS. The SID is used for the purpose of upstream bandwidth allocation and class-of-service management.

Signal-to-Noise—S/N (also SNR). The difference in amplitude between a baseband signal and the noise in a portion of the spectrum.

spectrum reuse—CATV's most fundamental concept. Historically, the over-the-air spectrum has been assigned to many purposes other than that of carrying TV signals. This has resulted in an inadequate supply of spectrum to serve the needs of viewers. Cable can reuse spectrum that is sealed in its aluminum tubes.

subscriber unit (SU)—An alternate term for cable access router. See *cable access router.*

upstream—The set of frequencies used to send data from a subscriber to the headend.

Configuration Tasks

The Cisco uBR924 cable access router typically is configured automatically on power-up using a configuration file generated by the cable service provider and delivered via the Cisco uBR7246 or the Cisco uBR7223 universal broadband router installed at the cable headend. All of the configuration tasks listed below are optional.

- Configuring a Host Name and Password on page 12
- Configuring Ethernet and Cable Access Router Interfaces on page 13
- Configuring Routing on page 14
- Configuring Bridging on page 16
- Reestablishing DOCSIS-Compliant Bridging on page 18
- Customizing the Cable Access Router Interface on page 19

Caution Before attempting to reconfigure a Cisco uBR924 cable access router at a subscriber site, contact your network management, provisioning manager, or billing system administrator to ensure remote configuration is allowed. If remote configuration is disabled, settings you make and save at the local site will not remain in effect after the cable access router is powered off and back on. Instead, settings will return to the previous configuration.

Note Console sessions and TTY sessions are supported by the cable access router.

Configuring a Host Name and Password

One of the first configuration tasks you might want to perform is to configure a host name and set an encrypted password. Configuring a host name allows you to distinguish multiple Cisco uBR924 cable access routers from each other. Setting an encrypted password allows you to prevent unauthorized configuration changes.

Note Passwords are case sensitive.

To configure a host name and an encrypted password for a Cisco uBR924 cable access router, perform the following tasks, starting in global configuration mode:

Step	Command	Purpose
1	`uBR924(config)# hostname cisco` `cisco(config)#`	Change the name of the uBR924 to a meaningful name. Substitute your host name for **cisco**.
2	`cisco(config)# enable secret guessme`	Enter an enable secret password. This password provides access to enable (privileged EXEC) mode. After configuring a password, when you enter **enable** at the EXEC prompt, you must enter the enable secret password to gain access to configuration mode. Substitute your enable secret password for **guessme**.
3	`cisco(config)# line console 0`	Enter line configuration mode to configure the console port.
	`cisco(config-line)# exec-timeout 0 0`	Prevent the EXEC facility from timing out if you do not type any information on the console screen for an extended period.
	`cisco(config-line)# exit` `cisco(config)#`	Exit back to global configuration mode.

Verifying the Host Name and Password

To verify that you configured the correct host name and password, enter the **show running-config** command from global configuration mode:

```
cisco(config)# show running-config
Using 1888 out of 126968 bytes
!
version XX.X
.
.
!
hostname cisco
!
enable secret 5 $1$60L4$X2JYOwoDc0.kqa1loO/w8/
```

- Check the host name and encrypted password displayed near the top of the command output.

- Exit global configuration mode and attempt to reenter it using the new enable password:

```
cisco# exit

cisco con0 is now available
Press RETURN to get started.
cisco> enable
Password: guessme
cisco#
```

Configuration, Verification, and Troubleshooting Tips

If you are having trouble:

- Make sure **Caps Lock** is off.
- Make sure you entered the correct passwords. Passwords are case sensitive.

Configuring Ethernet and Cable Access Router Interfaces

To assign an IP address to the Ethernet or cable access router interface so that it can be recognized as a device on the Ethernet LAN, perform the following tasks, starting in global configuration mode:

Step	Command	Purpose

1	`uBR924(config)# interface ethernet 0`
	
	or
	
	`uBR924(config)# interface modem-cable0`
	
	`uBR924(config-if)#`
		Enter interface configuration mode for the Ethernet and/or the cable access router interface.

2	`uBR924(config-if)# ip address 172.16.1.1 255.255.255.0`	Assign the appropriate IP address and subnet mask to the interface.

3	`uBR924(config-if)# Ctrl-Z`
	`uBR924#`
	
	`%SYS-5-CONFIG_I: Configured from console by console`
		Return to privileged EXEC mode.
		
		This message is normal and does not indicate an error.

Verifying IP Address Configuration

To verify that you have assigned the correct IP address, enter the **show arp** command:

```
uBR924# show arp
Protocol  Address     Age (min)  Hardware Addr   Type   Interface
Internet  172.16.1.1        -    0009.0613.6030  ARPA   cable-modem0
Internet  4.0.0.28          -    00e0.1ed7.524d  ARPA   Ethernet0
```

Configuration, Verification, and Troubleshooting Tips

If you are having trouble:

- Make sure you are using the correct IP address.
- Make sure the cable interface is not shut down. Use the **show running-config** command to check the cable interface status.

Configuring Routing

DOCSIS-compliant transparent bridging is the factory default configuration of the Cisco uBR924 cable access router. To change the configuration of your cable access router from bridging to routing using the CLI, perform the following tasks, starting in global configuration mode:

Step	Command	Purpose
1	uBR924(config)#**interface cable-modem0**	Enter interface configuration mode for the cable access router interface.
2	uBR924(config-if)#**no cable-modem compliant bridge**	Turn off DOCSIS-compliant bridging.
	uBR924(config-if)#**no bridge-group 59**	Remove the default bridge group assignment from the cable interface.
	uBR924(config-if)#**end**	Return to global configuration mode.
3	uBR924(config)#**ip routing**	Enable IP routing for the cable access router.
	uBR924(config)#**ip subnet-zero**	Enable the use of subnet zero for interface addresses and routing updates.
	uBR924(config)#**ip route** *<IP address of CMTS> <subnet mask of CMTS>*	Create a static route to the CMTS to make sure that Time of Day (TOD) packets are properly routed out of the cable access router.
4	uBR924(config)#**router rip**	Enter router configuration mode and enable Routing Information Protocol (RIP) on the cable access router.
5	uBR924(config-router)#**network** *network-number*	Specify the network connected to the cable access router on which the RIP process will operate. If the cable access router is attached to more than one network, enter each IP address in a separate command.
6	uBR924(config-router)#**end**	Exit router configuration mode.
	uBR924(config)#**interface cable-modem0**	Return to interface configuration mode for the cable access router interface.
7	uBR924(config-if)#**ip rip receive v 2**	Specify that only RIP Version 2 packets will be received on the coaxial cable interface.
8	uBR924(config-if)#**ip rip send v 2**	Specify that only RIP Version 2 packets will be sent on the coaxial cable interface.
9	uBR924(config-if)#**end**	Exit interface configuration mode for the cable access router interface and enter interface configuration mode for the Ethernet0 interface.
	uBR924(config)#**interface ethernet0**	
10	uBR924(config-if)#**no bridge-group 59**	Remove the default bridge group assignment from the Ethernet0 interface.
11	uBR924(config-if)#**ip rip receive v 2**	Specify that only RIP Version 2 packets will be received on this Ethernet interface.
12	uBR924(config-if)#**ip rip send v 2**	Specify that only RIP Version 2 packets will be sent on this Ethernet interface.
13	uBR924(config-if)#**Ctrl-z**	Return to privileged EXEC mode.
	uBR924#**copy running-config startup-config** Building configuration...	Save the configuration to nonvolatile RAM so that it won't be lost in the event of a reset, power cycle, or power outage.

Verifying Routing

To verify that bridging is not configured, routing is enabled, and that Routing Information Protocol is configured on the interfaces, enter the **show startup-config** command:

```
uBR924# show startup-config
Building configuration...

Current configuration:
!
version 12.0
no service pad
no service password-encryption
service udp-small-servers
service tcp-small-servers
!
hostname uBR924
!
!
clock timezone - 4
ip subnet-zero
!
!
!
voice-port 0
!
voice-port 1
!
!
interface Ethernet0
 ip address 10.1.0.33 255.255.0.0
 no ip directed-broadcast
 ip rip send version 2
 ip rip receive version 2
 no keepalive
!
interface cable-modem0
 ip address 172.16.1.42 255.255.0.0
 no ip directed-broadcast
 ip rip send version 2
 ip rip receive version 2
 no keepalive
cable-modem downstream saved channel 699000000 39
 no cable-modem compliant bridge
 !
router rip
 network 4.0.0.0
 network 172.16.0.0
!
ip classless
no ip http server
!
line con 0
 transport input none
line vty 0 4
 !
end
```

Configuring Bridging

The Cisco uBR924 cable access router is configured for DOCSIS-compliant transparent bridging by default. If it becomes necessary to *reconfigure* the unit for bridging after it has been configured for routing, you can erase the routing configuration and return the unit to factory default configuration settings, or you can reconfigure the unit manually using the CLI. To return the cable access router to factory default settings, see the section "Reestablishing DOCSIS-Compliant Bridging" on page 18 for details. To reconfigure the cable access router manually, perform the following tasks, starting in global configuration mode:

Step	Command	Purpose
1	uBR924(config)#**no service pad**	Disable packet assembler/disassembler commands; prevent the uBR924 from accepting incoming or outgoing Packet Assembler/Disassembler (PAD) connections.
2	uBR924(config)#**no service password-encryption**	Disable password encryption.
3	uBR924(config)#**no ip routing**	Disable IP routing on the uBR924.
4	uBR924(config)#**interface Ethernet0**	Enter interface configuration mode for the Ethernet0 interface.
5	uBR924(config-if)#**no ip address**	Disable the IP address on the Ethernet0 interface.
6	uBR924(config-if)#**no ip route-cache**	Disable high-speed switching caches for IP routing.
7	uBR924(config-if)#**bridge-group** *bridge-group*	Assign the Ethernet0 interface to a bridge group. The bridge group must be an integer between 1 and 63.
8	uBR924(config-if)#**bridge-group** *bridge-group* **spanning-disabled**	Disable spanning tree on the Ethernet interface.
9	uBR924(config-if)#**end** uBR924(config)#**interface cable-modem0**	Exit interface configuration mode for the Ethernet0 interface and enter interface configuration mode for the cable access router interface.
10	uBR924(config-if)#**no ip address**	Disable the IP address of the coaxial cable interface, if one has been set. The uBR7246 cable router assigns an IP address to the cable access router each time it connects to the network.
11	uBR924(config-if)#**no ip route-cache**	Disable high-speed switching caches for IP routing on the cable interface.
12	uBR924(config-if)#**no keepalive**	Disable keepalives on the cable interface.
13	uBR924(config-if)#**cable-modem compliant bridge**	Enable DOCSIS-compliant bridging.
14	uBR924(config-if)#**bridge-group** *bridge-group*	Assign the cable access router interface to a bridge group. The bridge group must be an integer from 1 to 63. (The default is 59.)
15	uBR924(config-if)#**bridge-group** *bridge-group* **spanning-disabled**	Disable spanning tree on the cable interface.
16	uBR924(config-if)#**end** uBR924(config)#**ip classless**	Exit interface configuration mode. (Optional) At times, the uBR924 might receive packets destined for a subnet of a network that has no network default route. This global configuration mode command allows the Cisco IOS software to forward such packets to the best network route possible.
17	uBR924(config)#**line console 0**	Enter line configuration mode to configure the console port.

Step	Command	Purpose
18	uBR924(config-line)#**line vty 0 4**	Identify the last line in a contiguous group of virtual terminals you want to configure.
19	uBR924(config-line)#**Ctrl-z** uBR924#**copy running-config startup-config** Building configuration...	Return to privileged EXEC mode. Save the configuration to nonvolatile RAM so that it won't be lost in the event of a reset, power cycle, or power outage.

When the cable interface comes up, the IP address and downstream channel are configured automatically.

Note To configure multiple PCs, repeat Steps 4 through 7 above for each additional PC. You can connect a maximum of three PCs to the Cisco uBR924 cable access router in a bridging application.

Verifying Bridging

To verify that routing has been disabled on all interfaces and that bridging has been reenabled, enter the **show startup-config** command from privileged EXEC mode:

```
uBR924# show startup-config
Building configuration...
Current configuration:
!
version 12.0
service config
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname uBR924
!
clock timezone - 4
ip subnet-zero
no ip routing
!
!
voice-port 0
!
!
voice-port 1
!
!
interface Ethernet0
 no ip address
 no ip directed-broadcast
 no ip route-cache
 bridge-group 59
 bridge-group 59 spanning-disabled
!
```

```
interface cable-modem0
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no keepalive
 cable-modem downstream saved channel 699000000 36
 bridge-group 59
 bridge-group 59 spanning-disabled
!
ip classless
!
line con 0
line vty 0 4
 login
!
end
```

Reestablishing DOCSIS-Compliant Bridging

To erase the current non-default cable access router configuration and return the unit to its factory default DOCSIS-compliant bridging configuration, perform the following task from privileged EXEC mode:

Step	Command	Purpose
1	uBR924#**erase startup config**	Erase the current configuration (assuming the current running configuration has been saved to NVRAM).

After entering this command, perform a warm reset of the Cisco uBR924 cable access router by pressing and holding down the Reset button for less than 10 seconds. For information on the location and operation of the Reset button, refer to the "Physical Description" section in the chapter "Installing the Cisco uBR924 Cable Access Router" in the *Cisco uBR924 Cable Access Router Installation and Configuration Guide*.

Verifying DOCSIS-Compliant Bridging

To verify that the cable access router is configured for DOCSIS-compliant bridging, enter the **show startup-config** command from privileged EXEC mode. The configuration should look like this:

```
uBR924# show startup-config
Building configuration...
Current configuration:
!
version 12.0
service config
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname uBR924
!
clock timezone - 4
ip subnet-zero
no ip routing
!
!
!
```

```
voice-port 0
!
!
voice-port 1
!
!
interface Ethernet0
 no ip address
 no ip directed-broadcast
 no ip route-cache
 bridge-group 59
 bridge-group 59 spanning-disabled
!
interface cable-modem0
 no ip address
 no ip directed-broadcast
 no ip route-cache
 no keepalive
 cable-modem downstream saved channel 699000000 36
 bridge-group 59
 bridge-group 59 spanning-disabled
!
ip classless
no ip http server
!
line con 0
 transport input none
line vty 0 4
 login
!
end
```

Customizing the Cable Access Router Interface

Different geographical regions and different cable plants use different frequency bands. The Cisco uBR924 cable access router uses a built-in default frequency scanning feature to address this issue. After the cable access router finds a successful downstream frequency channel, it saves the channel and power setting to NVRAM. The cable access router recalls this value the next time it needs to synchronize its frequency or register with the cable service provider's CMTS.

However, you can customize the cable access router's interface configuration if you need to deviate from the default setting that ships with the unit. For example, you might need to specify a different compliant mode, modify the saved downstream channel setting and upstream power value, or enable a faster downstream search algorithm.

Note Most cable network scenarios will not require you to use these commands.

To customize the cable access router interface, perform the following tasks, starting in global configuration mode:

Step	Command	Purpose
1	`uBR924(config)#` **`interface cable-modem 0`**	Specify cable access router interface 0.
2	`uBR924(config-if)#` **`cable-modem compliant bridge`**	Enable DOCSIS-compliant bridging.

Step	Command	Purpose
3	uBR924(config-if)#**cable-modem downstream saved channel** *ds-frequency us-power*	Modify the saved downstream channel setting and upstream power value. If you do this, you must specify an exact downstream frequency and a power value.[1]
4	uBR924(config-if)#**cable-modem fast-search**	Enable a faster downstream search algorithm.

1Use the **no cable-modem downstream saved channel** *ds-frequency us-power* command to remove a saved frequency and power setting from NVRAM.

Configuration Examples

This section provides the following configuration examples:

- Basic Internet Access Bridging Configuration on page 20
- Basic Internet Access Routing Configuration on page 21
- Multicast-Enabled Routing Configuration on page 22
- VoIP Bridging Configuration Using H.323v2 on page 23
- VoIP Routing Configuration Using H.323v2 on page 24

Basic Internet Access Bridging Configuration

The following Cisco uBR924 cable access router configuration supports a typical residential Internet-access, data only subscriber:

```
Current configuration:
!
version 12.0
service config
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname uBR924
!
clock timezone - 4
ip subnet-zero
no ip routing
!
!
voice-port 0
!
!
voice-port 1
!
!
interface Ethernet0
 ip address 172.16.1.40 255.255.0.0
 no ip directed-broadcast
 no ip route-cache
 bridge-group 59
 bridge-group 59 spanning-disabled
!
```

```
interface cable-modem0
 ip address 172.16.1.40 255.255.0.0
 no ip directed-broadcast
 no ip route-cache
 cable-modem downstream saved channel 699000000 36
 bridge-group 59
 bridge-group 59 spanning-disabled
!
ip classless
no ip http server
!
line con 0
 transport input none
line vty 0 4
 login
!
end
```

Basic Internet Access Routing Configuration

The Cisco uBR924 cable access router can be configured to act as a router to preserve IP address space and limit broadcasts that can impact the performance of the network. A sample configuration file follows.

Note To configure the Cisco uBR924 to act as a router, the **no cable-modem compliant bridge** command must be used. In addition, the **bridge group 59** command must be removed from the Ethernet and cable-modem interfaces.

```
Current configuration:
!
version 12.0
service config
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname uBR924
!
!
clock timezone - 4
ip subnet-zero
!
!
!
voice-port 0
!
voice-port 1
!
!
interface Ethernet0
 ip address 10.1.0.33 255.255.0.0
 no ip directed-broadcast
 !
```

```
interface cable-modem0
 ip address 172.16.1.42 255.255.0.0
 no ip directed-broadcast
 cable-modem downstream saved channel 699000000 39
 no cable-modem compliant bridge
 !
router rip
 network 4.0.0.0
 network 172.16.0.0
!
ip classless
no ip http server
!
line con 0
 transport input none
line vty 0 4
 !
end
```

Multicast-Enabled Routing Configuration

The following configuration is for a Cisco uBR924 that uses PIM sparse-dense mode and belongs to a specific multicast group. Other multicast routing protocols such as PIM sparse-mode or PIM dense-mode can be used.

```
Current configuration:
!
! Last configuration change at 23:16:44 - Thu Mar 18 1999
!
version 12.0
service config
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname uBR924
!
!
clock timezone - 4
ip subnet-zero
!
!
ip multicast-routing
ip dvmrp route-limit 20000
!
!
voice-port 0
!
voice-port 1
!
!
interface Ethernet0
 ip address 24.1.0.1 255.255.0.0
 no ip directed-broadcast
 ip pim sparse-dense-mode
 no ip route-cache
 no ip mroute-cache
!
```

```
interface cable-modem0
 ip address 10.1.0.25 255.255.0.0
 no ip directed-broadcast
 ip pim sparse-dense-mode
 no ip route-cache
 no ip mroute-cache
 cable-modem downstream saved channel 477000000 56
 no cable-modem compliant bridge
!
!
router rip
 version 2
 network 24.0.0.0

network 10.0.0.0
!
!
ip classless
no ip http server
!
!
line con 0
 transport input none
line vty 0 4
!
end
```

VoIP Bridging Configuration Using H.323v2

In this example, the Cisco uBR924 is configured for bridging, with an H.323v2 dial peer to another Cisco uBR924 attached to the same downstream interface on the headend CMTS.

```
Current configuration:
!
! Last configuration change at 21:54:41 - Thu Apr 29 1999
! NVRAM config last updated at 21:56:20 - Thu Apr 29 1999
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 2007
!
!
clock timezone - 3
ip subnet-zero
no ip routing
!
!
voice-port 0
 input gain -3
!
voice-port 1
 input gain -3
!
dial-peer voice 1 pots
 destination-pattern 6501
 port 0
!
```

```
dial-peer voice 2 pots
 destination-pattern 6502
 port 1
!
dial-peer voice 62 voip
 destination-pattern 620.
 session target ipv4:10.1.71.62
!
!
interface Ethernet0
 ip address 10.1.71.65 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 bridge-group 59
 bridge-group 59 spanning-disabled
!
interface cable-modem0
 description DHCP Reserved Address 10.1.71.65
 ip address 10.1.71.65 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 cable-modem downstream saved channel 537000000 27
 bridge-group 59
 bridge-group 59 spanning-disabled
!
ip classless
no ip http server
!
!
line con 0
 exec-timeout 0 0
 transport input none
line vty 0 4
 login
!
!
end
```

VoIP Routing Configuration Using H.323v2

In this example, the Cisco uBR924 is configured for IP routing, with an H.323v2 dial peer to another Cisco uBR924 attached to the same downstream interface on the headend CMTS.

```
Current configuration:
!
! No configuration change since last restart
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname 2007
!
!
class-map class-default
  match any
!
!
clock timezone - 3
ip subnet-zero
!
!
```

```
voice-port 0
!
voice-port 1
!
dial-peer voice 1 pots
 destination-pattern 6101
 port 0
!
dial-peer voice 2 pots
 destination-pattern 6102
 port 1
!
dial-peer voice 101 voip
 destination-pattern 620*
 codec g711alaw
 session target ipv4:10.1.71.62
!
!
interface Ethernet0
 ip address 24.1.61.1 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
!
interface cable-modem0
 ip address 10.1.71.61 255.255.255.0
 no ip directed-broadcast
 no ip mroute-cache
 cable-modem downstream saved channel 537000000 27
 no cable-modem compliant bridge
!
router rip
 version 2
 network 10.0.0.0
 network 24.0.0.0
 no auto-summary  <<==== Not necessary
!
no ip classless
ip route 0.0.0.0 0.0.0.0 10.1.71.1
no ip http server
!
!
line con 0
 exec-timeout 0 0
 transport input none
line vty 0 4
 login
!
!
end
```

NAT/PAT Configuration

```
Current configuration:
!
! No configuration change since last restart
!
version 12.0
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname uBR924
!
!
ip nat inside source list 1 interface cable-modem0 overload
clock timezone - -4
!
!
interface Ethernet0
 ip address 10.1.1.1 255.255.255.0
 ip nat inside
!
interface cable-modem0
 ip address 24.3.90.20 255.255.255.0
 ip nat outside
 no keepalive
 cable-modem downstream saved channel 627000000 54
 no cable-modem compliant bridge
!
ip default-gateway 24.3.90.2
ip classless
ip route 0.0.0.0 0.0.0.0 24.3.90.2
access-list 1 permit any
!
line con 0
line vty 0 4
 login
!
end
```

Command Reference

This section describes the following cable-modem interface commands for the Cisco uBR924 cable access router for Cisco IOS Release 12.0(5)T:

- **cable-modem compliant bridge**
- **cable-modem downstream saved channel**
- **cable-modem fast-search**
- **cable-modem upstream preamble qpsk**
- **cable-modem voip best-effort**
- **interface cable-modem**
- **show bridge cable-modem**
- **show dhcp**
- **show interfaces cable-modem**

All commands relating to VoIP applications are documented in the Cisco IOS Release 12.0 command references, or in *Voice over IP for the Cisco AS5300*, which can be accessed online or on the Documentation CDROM by going to **New Features in Cisco IOS Release 12.0(3)T**.

All other commands used with this feature are documented in the Cisco IOS Release 12.0 command references.

cable-modem compliant bridge

To enable DOCSIS-compliant transparent bridging for a cable access router interface at startup, use the **cable-modem compliant** command from interface configuration mode. Use the **no** form of this command to disable DOCSIS-compliant bridging for the interface.

cable-modem compliant bridge

no cable-modem compliant bridge

Syntax Description

This command has no arguments or keywords.

Defaults

Enabled

Command Modes

Interface configuration

Command History

Release	Modification
11.3 NA	This command was first introduced.

Usage Guidelines

It is normally not necessary to enter this command in data-over-cable bridging applications because DOCSIS-compliant bridging is enabled by default. If you wish to do full transparent bridging rather than DOCSIS-compliant bridging, use the **no** form of the command, then configure full transparent bridging using CLI commands. See the "Configuring Bridging" section on page 16 for instructions.

Examples

The following example shows how to enter the **cable-modem compliant bridge** command for a cable access router interface, starting from global configuration mode:

```
uBR924(config)# interface cable-modem 0
uBR924(config-if)# cable-modem compliant bridge
uBR924(config-if)#
```

Related Commands

Command	Description
cable-modem downstream saved channel	Modifies the saved downstream channel setting and upstream power value on the cable interface of a Cisco uBR924.
cable-modem fast-search	Enables a faster downstream search algorithm on the cable interface of a Cisco uBR924.
cable-modem upstream preamble qpsk	Enables the QPSK modulation scheme in the upstream direction from the Cisco uBR924 to the CMTS.
cable-modem voip best-effort	Allows voice traffic to be transmitted on the upstream via best effort rather than by assigning it a higher priority class of service.

cable-modem downstream saved channel

To modify the saved downstream channel setting and upstream power value on a cable access router interface, enter the **cable-modem downstream saved channel** command from interface configuration mode. Use the **no** form of this command to remove the saved settings, which will be resaved at the next initialization cycle.

cable-modem downstream saved channel *ds-frequency us-power*

no cable-modem downstream saved channel *ds-frequency us-power*

Syntax Description

ds-frequency	Downstream channel frequency in Hz, which can be from 91000000 to 860000000.
us-power	Upstream power level in decibels per millivolt (dBmV), which can be from 8 to 61.

Defaults

Enabled

Command Modes

Interface configuration

Command History

Release	Modification
11.3 NA	This command was first introduced.

Usage Guidelines

This command is auto-generated by the operation of the cable MAC layer process. The DOCSIS RFI specification requires that cable modems remember the downstream frequency and upstream power of the last successfully ranged session. These parameters are called up as the first downstream frequency and upstream power to use the next time the cable modem is booted. This operation dramatically speeds up the channel search.

Use the **no cable-modem downstream saved channel** *ds-frequency us-power* command to remove the saved frequency and power setting from the running configuration, which will be resaved at the next initialization cycle.

Cisco recommends that this command NOT be used by end users of the Cisco uBR924 cable access router.

Examples

The following example shows how to remove the downstream frequency of 91000000 Hz and the upstream power level of 33 dBmV from the running configuration of a cable-modem interface, starting from global configuration mode.

```
uBR924(config)# interface cable-modem 0
uBR924(config-if)# no cable-modem downstream saved channel 91000000 33
uBR924(config-if)#
```

Related Commands

Command	Description
cable-modem compliant bridge	Enables DOCSIS-compliant transparent bridging on the Cisco uBR924 at startup.
cable-modem fast-search	Enables a faster downstream search algorithm on the cable interface of a Cisco uBR924.
cable-modem upstream preamble qpsk	Enables the QPSK modulation scheme in the upstream direction from the Cisco uBR924 to the CMTS.
cable-modem voip best-effort	Allows voice traffic to be transmitted on the upstream via best effort rather than by assigning it a higher priority class of service.

cable-modem fast-search

To enable a faster downstream search algorithm on a cable access router interface, use the **cable-modem fast-search** command from interface configuration mode. Use the **no** form of this command to disable the downstream fast-search feature.

cable-modem fast-search

no cable-modem fast-search

Syntax Description

There are no keywords or arguments for this command.

Defaults

Disabled

Command Modes

Interface configuration

Command History

Release	Modification
11.3 NA	This command was first introduced.

Usage Guidelines

This feature speeds up the frequency search performed by the cable access router. Normally it takes the cable access router about 30 to 50 seconds to sample 30 to 50 frequencies. The **cable-modem fast-search** command can reduce this search time. However, there might be some cases where this fast-search algorithm might not perform as well as the default algorithm. Trial and error is the only way to discover how well this feature works for your environment.

Examples

The following example shows how to enter the **cable-modem fast-search** command, starting from global configuration mode:

```
uBR924(config)# interface cable-modem 0
uBR924(config-if)# cable-modem fast-search
uBR924(config-if)#
```

Related Commands

Command	Description
cable-modem compliant bridge	Enables DOCSIS-compliant transparent bridging on the Cisco uBR924 at startup.
cable-modem downstream saved channel	Modifies the saved downstream channel setting and upstream power value on the cable interface of a Cisco uBR924.
cable-modem upstream preamble qpsk	Enables the QPSK modulation scheme in the upstream direction from the Cisco uBR924 to the CMTS.
cable-modem voip best-effort	Allows voice traffic to be transmitted on the upstream via best effort rather than by assigning it a higher priority class of service.

cable-modem upstream preamble qpsk

To enable the QPSK modulation scheme in the upstream direction from the cable access router interface to the headend, enter the **cable-modem upstream preamble qpsk** command from interface configuration mode. Use the **no** form of this command to disable upstream modulation for the interface.

cable-modem upstream preamble qpsk

no cable-modem upstream preamble qpsk

Syntax Description

This command has no arguments or keywords.

Defaults

Enabled

Command Modes

Interface configuration

Command History

Release	Modification
11.3 NA	This command was first introduced.

Usage Guidelines

Examples

The following example shows how to enter the **cable-modem upstream preamble qpsk** command for a cable access router interface, starting from global configuration mode:

```
uBR924(config)# interface cable-modem 0
uBR924(config-if)# cable-modem upstream preamble qpsk
uBR924(config-if)#
```

Related Commands

Command	Description
cable-modem compliant bridge	Enables DOCSIS-compliant transparent bridging on the Cisco uBR924 at startup.
cable-modem downstream saved channel	Modifies the saved downstream channel setting and upstream power value on the cable interface of a Cisco uBR924.
cable-modem fast-search	Enables a faster downstream search algorithm on the cable interface of a Cisco uBR924.
cable-modem voip best-effort	Allows voice traffic to be transmitted on the upstream via best effort rather than by assigning it a higher priority class of service.

cable-modem voip best-effort

To allow voice calls to be sent upstream over the cable interface via best effort, use the **cable-modem voip best-effort** command from interface configuration mode. To disable best-effort voice calls, use the **no** form of this command.

cable-modem voip best-effort

no cable-modem voip best-effort

Syntax Description

This command has no arguments or keywords.

Defaults

Enabled.

Command Modes

Interface configuration

Command History

Release	Modification
12.0(5)T	This command was first introduced.

Usage Guidelines

This command allows you to configure the voice traffic on a Cisco uBR924 to allow only calls having a high priority service identifier (SID) to be connected.

If the dynamic configuration of high priority queues for voice traffic fails, or if the far end cannot support the multiple SIDs and multiple classes of service required by high priority traffic, the flag set by this command will be checked. If enabled (the default setting), the call will be allowed to go through. If disabled, the call will fail.

Examples

The following example shows how to disable best-effort voice calls on a Cisco uBR924 cable interface, starting from global configuration mode:

```
uBR924(config)# interface cable-modem 0
uBR924(config-if)# no cable-modem voip best-effort
uBR924(config-if)#
```

Related Commands

Command	Description
cable-modem compliant bridge	Enables DOCSIS-compliant transparent bridging on the Cisco uBR924 at startup.
cable-modem downstream saved channel	Modifies the saved downstream channel setting and upstream power value on the cable interface of a Cisco uBR924.
cable-modem fast-search	Enables a faster downstream search algorithm on the cable interface of a Cisco uBR924.
cable-modem upstream preamble qpsk	Enables the QPSK modulation scheme in the upstream direction from the Cisco uBR924 to the CMTS.

interface cable-modem

To specify the cable interface on a Cisco uBR924 cable access router, enter the **interface cable-modem** command from global configuration mode.

interface cable-modem *number*

Syntax Description

number	The interface number of the cable interface on the rear panel of the cable access router.

Defaults

Disabled

Command Modes

Global configuration

Command History

Release	Modification
11.3 NA	This command was first introduced.

Usage Guidelines

When this command is entered, the Cisco uBR924 cable access router switches from global configuration mode to interface configuration mode.

Examples

The following example brings up cable access router interface 0 and displays the available cable-modem interface configuration commands:

```
uBR924(config)# interface cable-modem 0
uBR924(config-if)# cable-modem ?
  compliant    Enter compliant modes for interface
  downstream   Downstream channel characteristics
  fast-search  Enable/disable the DS fast search
  upstream     upstream channel characteristics
  voip         Options for Voice over IP traffic over the cable interface

uBR924(config-if)#
```

Related Commands

Command	Description
cable-modem compliant bridge	Enables DOCSIS-compliant transparent bridging on the Cisco uBR924 at startup.
cable-modem downstream saved channel	Modifies the saved downstream channel setting and upstream power value on the cable interface of a Cisco uBR924.
cable-modem fast-search	Enables a faster downstream search algorithm on the cable interface of a Cisco uBR924.
cable-modem upstream preamble qpsk	Enables the QPSK modulation scheme in the upstream direction from the Cisco uBR924 to the CMTS.
cable-modem voip best-effort	Allows voice traffic to be transmitted on the upstream via best effort rather than by assigning it a higher priority class of service.

show bridge cable-modem

To display bridging information for a Cisco uBR924 cable access router, enter the **show bridge cable-modem** command from privileged EXEC mode.

show bridge cable-modem *number*

Syntax Description

number	The interface number of the cable interface on the rear panel of the Cisco uBR924.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3 NA	This command was first introduced.

Examples

Following is a sample output for this command:

```
uBR924# show bridge cable-modem 0

Total of 300 station blocks, 298 free
Codes: P - permanent, S - self

Bridge Group 59:
```

Table 1 describes the significant fields shown in the display.

Table 1 Show Bridge Cable-Modem Field Descriptions

Field	Description
Total of 300 station blocks	Total number of forwarding database elements in the system. The memory to hold bridge entries is allocated in blocks of memory sufficient to hold 300 individual entries. When the number of free entries falls below 25, another block of memory sufficient to hold another 300 entries is allocated. Thus, the total number of forwarding elements in the system is expanded dynamically, as needed, limited by the amount of free memory in the router.
Bridge Group	The number of the bridge group to which this interface is assigned.

Related Commands

Command	Description
show dhcp	Displays the current DHCP settings on point-to-point interfaces.
show interfaces cable-modem	Displays information about the cable interface on the Cisco uBR924 cable access router.

show dhcp

To display the current DHCP settings on point-to-point interfaces, enter the **show dhcp** command from privileged EXEC mode.

show dhcp {**lease** | **server**}

Syntax Description

lease	Shows DHCP addresses leased from a server.
server	Shows known DHCP servers.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3 NA	This command was first introduced.

Usage Guidelines

You can use this command on any point-to-point type of interface that uses DHCP for temporary IP address allocation.

Examples

Following is sample output for the **show dhcp lease** command:

```
uBR924# show dhcp lease
Temp IP addr: 188.188.1.40  for peer on Interface: cable-modem0
Temp sub net mask: 0.0.0.0
   DHCP Lease server: 4.0.0.32, state: 3 Bound
   DHCP transaction id: 2431
   Lease: 3600 secs,  Renewal: 1800 secs,  Rebind: 3150 secs
Temp default-gateway addr: 188.188.1.1
   Next timer fires after: 00:58:01
   Retry count: 0   Client-ID: 0010.7b43.aa01
```

Table 2 describes the significant fields shown in the display.

Table 2 Show DHCP Lease Field Descriptions

Field	Description
Temp IP addr	IP address leased from the DHCP server for the cable access router interface.
Temp subnet mask	Temporary subnet mask assigned to the cable access router interface.
DHCP Lease server	IP address of the DHCP server that assigned an IP address to this client.
state	Current state of this client (the cable access router interface). Possible states are Bound, Renew, or Rebinding. For descriptions of these states, see RFC 2131.
DHCP transaction id	Unique number established by the Cisco uBR924 before the first request message is sent to the DHCP server. The same transaction id is used as long as the lease keeps getting renewed and is valid. If a new "discover" message is sent, a new transaction id is used.
Lease	Time (in seconds) for which the leased IP address is valid; the duration of the lease.
Renewal	Time interval (in seconds) from address assignment until the client transitions to the renewing state. When the renewal (T1) time expires, the client sends a unicast dhcprequest message to the server to extends its lease. The default value of this timer is 0.5 times the duration of the lease.
Rebind	Time interval (in seconds) from address assignment until the client transitions to the rebinding state and sends a broadcast dhcprequest message to any DHCP server to extends its lease. The default value of this timer (T2) is 0.875 times the duration of the lease.
Temp default-gateway addr	IP address of the router closest to this client on the network.
Next timer fires after	Time in hours, minutes, and seconds until the next timer expires.
Retry count	Number of times the client has sent any message to the DHCP server -- most likely a request message to extend its lease. When the lease is renewed, the Retry count is reset to 0.
Client-ID	MAC address (with optional media type code) that uniquely identifies the client on the subnet for binding lookups.

Following is sample output for the **show dhcp server** command:

```
uBR924# show dhcp server
   DHCP server: ANY (255.255.255.255)
    Leases:   1
    Offers:   1      Requests: 2     Acks: 1     Naks: 0
    Declines: 0      Releases: 0     Bad:  0
    TFTP Server Name: SOHOSERVER
    TIME0: 1.2.0.250,  TIME1: 0.0.0.0
    Subnet: 255.255.255.0
```

Table 3 describes the significant fields shown in the display.

Table 3 Show DHCP Server Field Descriptions

Field	Description
DHCP server	MAC address used by the DHCP server.
Leases	Number of current leased IP addresses.
Offers	Number of offers for an IP address sent to a proxy-client from the server.
Requests	Number of requests for an IP address to the server.

Table 3 Show DHCP Server Field Descriptions (continued)

Field	Description
Acks	Number of ‘acknowledge’ messages sent by the server to the proxy-client.
Naks	Number of ‘not acknowledge’ messages sent by the server to the proxy-client.
Declines	Number of offers from the server that have been declined by the proxy-client.
Releases	Number of times IP addresses have been relinquished gracefully by the client.
Bad	Number of bad packets received due to wrong length, wrong field type, or other causes.
TFTP Server Name	Name (if any) configured for the server providing TFTP downloads to the cable modem.
TIME0	IP address of the primary Time of Day (TOD) server.
TIME1	IP address of the secondary Time of Day (TOD) server.
Subnet	Subnet containing the DHCP server.

Related Commands

Command	Description
cable-modem voip best-effort	Allows voice traffic to be transmitted on the upstream via best effort rather than by assigning it a higher priority class of service.
show bridge cable-modem	Ddisplays bridging information for a Cisco uBR924 cable access router.
show interfaces cable-modem	Displays information about the cable interface on the Cisco uBR924 cable access router.

show interfaces cable-modem

To display information about the Cisco uBR924 cable access router's cable interface, enter the **show interfaces cable-modem** command from either user EXEC mode or privileged EXEC mode.

show interfaces cable-modem *number* [**accounting | counters | crb | irb | type**]

Syntax Description

number	Cable access router interface number.
accounting	(Optional) Displays the number of packets of each protocol type that has been sent through the cable access router interface.
counters	(Optional) Shows MIB counters on the cable interface.
crb	(Optional) Displays concurrent routing and bridging information for each interface that has been configured for routing or bridging. This option does not really apply to the Cisco uBR924; it is included because it is part of the subsystem that provides DOCSIS-compliant bridging. For more information, refer to the *Bridging and IBM Networking Command Reference*.
irb	(Optional) Displays integrated routing and bridging information for each interface that has been configured for routing or bridging. This option does not really apply to the Cisco uBR924; it is included because it is part of the subsystem that provides DOCSIS-compliant bridging. For more information, refer to the *Bridging and IBM Networking Command Reference*.
type	(Optional) Designed to display information about virtual LANs associated with the interface; however, this option is not supported on the Cisco uBR924.

Defaults

No default behavior or values.

Command Modes

User EXEC or privileged EXEC

Command History

Release	Modification
11.3 NA	This command was first introduced.

Usage Guidelines

When this command is entered without a keyword, general information about the cable interface is displayed.

Examples

Traffic passing through the cable access router interface is shown in the following example:

```
uBR924# show interfaces cable-modem 0
  cable-modem0 is up, line protocol is up
  Hardware is BCM3300, address is 0050.7366.2439 (bia 0050.7366.2439)
  Internet address is 5.2.0.11/16
  MTU 1500 bytes, BW 27000 Kbit, DLY 1000 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation DOCSIS, loopback not set
  Keepalive set (10 sec)
  ARP type:ARPA, ARP Timeout 04:00:00
  Last input 00:00:00, output 00:00:00, output hang never
  Last clearing of "show interface" counters 00:08:40
  Queueing strategy:fifo
  Output queue 40/40, 52787 drops; input queue 0/75, 0 drops
  5 minute input rate 2000 bits/sec, 2 packets/sec
  5 minute output rate 94000 bits/sec, 154 packets/sec
     1074 packets input, 418472 bytes, 0 no buffer
     Received 19 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     78771 packets output, 6326786 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Table 4 describes the significant fields shown in the display.

Table 4 Show Interfaces Cable-Modem Field Descriptions

Field	Description
cable-modem0 is up	Indicates that the interface is currently active. “Disabled” indicates the interface has received more than 5000 errors in one keepalive interval (10 seconds by default if keepalive is set); “administratively down” indicates the interface has been taken down by an administrator.
line protocol is up	Indicates that the software processes that handle the line protocol believe the interface is usable.
Hardware	Hardware type and MAC address.
Internet address	Internet address followed by the shorthand notation for the subnet mask.
MTU	Maximum Transmission Unit (equivalent of the maximum packet size) for the interface.
BW	Bandwidth of the interface in kilobits per second.
DLY	Delay of the interface in microseconds.
reliability	Reliability of the interface, expressed as a fraction of 255, calculated as an exponential average over a 5-minute period. (255/255 equals 100% reliability.)
tx load/rx load	Load on the interface caused by transmitting and receiving, expressed as a fraction of 255, calculated as an exponential average over a 5 minute period.
Encapsulation/loopback/keepalive	Encapsulation method assigned to the interface.
loopback	Indicates whether or not loopback is set.
keepalive	Indicates whether or not keepalives are set.
ARP type	Type of Address Resolution Protocol configured for the interface.
ARP Timeout	Number of hours, minutes, and seconds an ARP cache entry will stay in the cache.

Table 4 Show Interfaces Cable-Modem Field Descriptions (continued)

Field	Description
Last input/output	Number of hours, minutes, and seconds since the last packet was successfully received/transmitted by the interface.
output hang	Number of hours, minutes, and seconds since the interface was last reset because of a transmission that took too long. When the number of hours in any of the "Last.." fields exceeds 24, the number of days and hours is displayed. If the field overflows, asterisks are printed.
Last clearing of "show interface" counters	Time at which the counters that measure cumulative statistics (such as number of bytes transmitted and received) shown in this report were last reset to zero. Note that variables that might affect routing (for example, load and reliability) are not cleared when the counters are cleared. *** indicates the elapsed time is too large to be displayed. 0:00:00 indicates the counters were cleared more than 2^{31} milliseconds (and less than 2^{32} milliseconds) ago.
Queueing strategy	Type of queueing strategy in effect on the interface.
Output queue/drops	Number of packets in the output queue followed by the size of the queue and the number of packets dropped due to a full queue.
input queue/drops	Number of packets in the input queue followed by the size of the queue and the number of packets dropped due to a full queue.
5 minute input rate 5 minute output rate	Average number of bits and packets received and transmitted per second in the last 5 minutes. If the interface is not in promiscuous mode, it senses network traffic it sends and receives (rather than all network traffic). The 5-minute input and output rates should be used only as an approximation of traffic per second during a given 5-minute period. These rates are exponentially weighted averages with a time constant of 5 minutes. A period of four time constants must pass before the average will be within two percent of the instantaneous rate of a uniform stream of traffic over that period.
packets input	Total number of error-free packets received by the system.
bytes input	Total number of bytes, including data and MAC encapsulation, in the error-free packets received by the system.
no buffer	Number of received packets discarded because there was no buffer space in the main system. Compare with ignored count. Broadcast storms on Ethernet networks and bursts of noise on serial lines are often responsible for no input buffer events.
Received broadcasts	Total number of broadcast or multicast packets received by the interface.
runts	Number of packets discarded because they were smaller than the medium's minimum packet size. For example, any Ethernet packet less than 64 bytes is considered a runt.
giants	Number of packets discarded because they were larger than the medium's maximum packet size. For example, any Ethernet packet larger than 1518 bytes is considered a giant.
throttles	Number of times the receiver on the port was disabled, possibly due to buffer or processor overload.
input errors	Includes runts, giants, no buffer, CRC, frame, overrun, and ignored counts. Other input-related errors can also cause the input errors count to be increased, and some datagrams may have more than one error; therefore, this sum may not balance with the sum of enumerated input error counts.

Table 4 Show Interfaces Cable-Modem Field Descriptions (continued)

Field	Description
CRC	Number of cyclic redundancy checksums generated by the originating LAN station or far-end device that do not match the checksum calculated from the data received. On a LAN, this usually indicates noise or transmission problems on the LAN interface or the LAN bus itself. A high number of CRCs is usually the result of collisions or a station transmitting bad data.
frame	Number of packets received incorrectly, having a CRC error and a noninteger number of octets. On a LAN, this is usually the result of collisions or a malfunctioning Ethernet device.
overrun	Number of times the receiver hardware was unable to hand received data to a hardware buffer because the input rate exceeded the receiver's ability to handle the data.
ignored	Number of received packets ignored by the interface because the interface hardware ran low on internal buffers. These buffers are different from the system buffers mentioned previously in the buffer description. Broadcast storms and bursts of noise can cause the ignored count to be increased.
abort	Number of packets whose receipt was aborted.
packets output	Total number of messages transmitted by the system.
bytes	Total number of bytes, including data and MAC encapsulation, transmitted by the system.
underruns	Number of times the transmitter has been running faster than the router can handle.
output errors	Sum of all errors that prevented the final transmission of datagrams out of the interface being examined. Note that this may not balance with the sum of the enumerated output errors, as some datagrams might have more than one error, and others might have errors that do not fall into any of the specifically tabulated categories.
collisions	Number of messages retransmitted due to an Ethernet collision. This is usually the result of an overextended LAN (Ethernet or transceiver cable too long, more than two repeaters between stations, or too many cascaded multiport transceivers). A packet that collides is counted only once in output packets.
interface resets	Number of times an interface has been completely reset. This can happen if packets queued for transmission were not sent within several seconds. On a serial line, this can be caused by a malfunctioning modem that is not supplying the transmit clock signal, or by a cable problem. If the system notices that the carrier detect line of a serial interface is up, but the line protocol is down, it periodically resets the interface in an effort to restart it. Interface resets can also occur when an interface is looped back or shut down.
output buffer failures	Number of times the output buffer has failed.
output buffers swapped out	Number of times the output buffer has been swapped out.

To display the number of packets and bytes of each protocol type passing through the cable access router interface, use the **accounting** option with the **show interface cable-modem** command:

```
uBR924# show interface cable-modem 0 accounting
cable-modem0
                Protocol    Pkts In   Chars In   Pkts Out  Chars Out
                      IP        545     185502        159      90240
           Trans. Bridge       3878     964995      12597    1611142
                     ARP         73       3066         86       4128
```

Table 5 describes the fields shown in this display.

Table 5 Show Interfaces Cable-Modem Accounting Descriptions

Field	Description
Protocol	List of protocols operating on the cable-modem interface.
Pkts In	Number of packets of each protocol received on the interface.
Chars In	Number of bytes of each protocol received on the interface.
Pkts Out	Number of packets of each protocol transmitted on the interface.
Chars Out	Number of bytes of cach protocol transmitted on the interface.

MIB counters on the cable interface are displayed in the next example:

```
uBR924# show int cable-modem 0 counters
Cable specific counters:
Ranging requests sent  : 50982
Downstream FIFO full   : 0
Re-requests            : 7277
DS MAC Message Overruns: 0
DS Data Overruns       : 0
Received MAPs          : 254339485
Received Syncs         : 53059555
Message CRC failures   : 0
Header CRC failures    : 1394
Data PDUs              : 5853
DS MAC messages        : 307861745
Valid Headers          : 307869065
Sync losses            : 0
Pulse losses           : 1
BW request failures    : 6
```

Table 6 describes the counters shown in this display.

Table 6 Show Interfaces Cable-Modem Counters Descriptions

Field	Description
Ranging requests sent	Number of ranging requests sent by the Cisco uBR924 to the CMTS.
Downstream FIFO full	Number of times the downstream input first-in first-out (FIFO) buffer became full on the Cisco uBR924.
Re-requests	Number of times a bandwidth request generated by the Cisco uBR924 was not responded to by the CMTS.
DS MAC Message Overruns	Number of times the Cisco uBR924's DMA controller had a downstream MAC message and there were no free MAC message buffer descriptors to accept the message.

Table 6 Show Interfaces Cable-Modem Counters Descriptions (continued)

Field	Description
DS Data Overruns	Number of times the Cisco uBR924's DMA controller had downstream data and there were no free data PDU buffer descriptors to accept the data.
Received MAPs	Number of times a MAP message passed all filtering requirements and was received by the Cisco uBR924.
Received Syncs	Number of times a timestamp message was received by the Cisco uBR924.
Message CRC failures	Number of times a MAC message failed a cyclic redundancy (CRC) check.
Header CRC failures	Number of times a MAC header failed its 16-bit CRC check. The MAC header CRC is a 16-bit Header Check Sequence (HCS) field that ensures the integrity of the MAC header even in a collision environment.
Data PDUs	Total number of data PDUs (protocol data units) of all types received by the Cisco uBR924.
DS MAC messages	Number of MAC messages received by the Cisco uBR924.
Valid Headers	Number of valid headers received by the Cisco uBR924, including PDU headers, MAC headers, and headers only.
Sync losses	Number of times the Cisco uBR924 lost timebase sync with the CMTS.
Pulse losses	Number of times the Cisco uBR924 did not receive expected timestamp messages from the CMTS.
BW request failures	Number of times the Cisco uBR924 sent the maximum number of re-requests for bandwidth allocation and the request was still not granted.

Information about routing and bridging protocols and filtering on the cable access router interface is displayed in the following example:

```
uBR924# show int cable-modem 0 crb

cable-modem0

 Bridged protocols on cable-modem0:
  ip

 Software MAC address filter on cable-modem0
  Hash Len    Address      Matches  Act      Type
  0x00:  0 ffff.ffff.ffff      3877 RCV Physical broadcast
  0x2A:  0 0900.2b01.0001         0 RCV DEC spanning tree
  0x7A:  0 0010.7b43.aa01       573 RCV Interface MAC address
  0xC2:  0 0180.c200.0000         0 RCV IEEE spanning tree
  0xC2:  1 0180.c200.0000         0 RCV IBM spanning tree
```

Table 7 describes the software MAC address filter information for the cable access router interface.

Table 7 Show Interfaces Cable-Modem Routing and Bridging Descriptions

Field	Description
Hash	Hash key/relative position in the keyed list for this MAC address filter.
Len	Length of this entry to the beginning element of this hash chain.
Address	Canonical (Ethernet ordered) MAC address of this filter.
Matches	Number of received packets that match this MAC address.

Table 7 Show Interfaces Cable-Modem Routing and Bridging Descriptions (continued)

Field	Description
Act	Action to be taken when this address is looked up; choices are to receive or discard the packet.
Type	MAC address type.

Related Commands

Command	Description
cable-modem compliant bridge	Enables DOCSIS-compliant transparent bridging on the Cisco uBR924 at startup.
cable-modem downstream saved channel	Modifies the saved downstream channel setting and upstream power value on the cable interface of a Cisco uBR924.
cable-modem fast-search	Enables a faster downstream search algorithm on the cable interface of a Cisco uBR924.
show bridge cable-modem	Displays bridging information for a Cisco uBR924 cable access router.
show interfaces cable-modem	Displays information about the cable interface on the Cisco uBR924 cable access router.

Debug Commands

All cable-modem debug commands used with the uBR924 cable access router are documented in *Troubleshooting Tips for the Cisco uBR924 Cable Access Router*, which can be accessed online or on the Documentation CDROM by going to **New Features in Cisco IOS Release 12.0(5)T**.

Note Hidden debug commands for the Cisco uBR924 cable access router are not documented.

All commands relating to VoIP applications are documented in the *Debug Command Reference* for Cisco IOS Release 12.0, which can be accessed online or on the Documentation CDROM by going to **Cisco IOS Release 12.0** and selecting **Supporting Documents**.